ANNUAL REPORT 1964

STRATFORD

water pollution control plant

DIVISION OF PLANT OPERATIONS
Ontario Water Resources Commission

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Stratford Local Advisory Committee,
City of Stratford.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Stratford Water Pollution Control Plant, OWRC Project No. 57-S-2.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D. S. Caverly,
General Manager

General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Stratford Water Pollution Control Plant, OWRC Project No. 57-S-2 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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STRATFORD
water pollution control plant

operated for

THE CITY OF STRATFORD

by the

ONTARIO WATER RESOURCES COMMISSION

CHAIRMAN: Dr. James A. Vance

VICE-CHAIRMAN: J. H. H. Root, M.P.P.

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Louis R. Desmarais **H. E. Brown**

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ASSISTANT GENERAL MANAGERS

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L. E. Owers

COMMISSION SECRETARY

W. S. MacDonell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: **C. W. Perry**
Regional Supervisor: **D. A. McTavish**
Operations Engineer: **B. G. Porter**

801 Bay Street **Toronto 5**

'64 REVIEW

The following report gives in detail significant data on the operation of the various treatment units at the Stratford Water Pollution Control Plant.

With an average daily flow of 2.72 million gallons, the plant is operating well below its full treatment capacity of 4.0 million gallons per day. Future sanitary sewer extensions will gradually increase the flow to design value.

Plans are presently being made to install chlorination equipment for chlorination of the final effluent. The addition of enough chlorine to produce a residual of 0.5 ppm is sufficient to disinfect the final effluent killing most of the pathogenic bacteria. Chlorination equipment can be expected to increase the operating costs of the plant.

The 1964 operating costs did not increase greatly over 1963. The treatment cost of $53.94 per million gallons has decreased considerably from the 1963 value of $68.15. Both values are considered to be economical.

Under the constant supervision of head office engineers, the plant staff has maintained a clean, attractive and efficient plant for the City of Stratford. A special emphasis is placed on public relations and aesthetic qualities of the plant. Each year many tourists and groups tour the facilities.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1957 - 1964

INCEPTION

In 1957, the City of Stratford and the Ontario Water Resources Commission initiated plans to extend the existing activated sludge treatment plant, which has been in operation since 1930.

The firm of Canadian-British Engineering Consultants was engaged to prepare plans and specifications for the project.

On July 5, 1957, the city signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the plant.

CONSTRUCTION

Schwenger Construction Company Limited of Hamilton began construction in 1957 and, in June of 1958, the Division of Plant Operations commenced operation of the new plant.

TOTAL COST

The cost of this plant extension was $925,000.

C. W. Biggin,
Chief Operator

Project Staff

Operators

J. Craig	J. E. Gotts
W. McManus	R. P. Ranton
R. Tuer	W. R. Marriott

COMMENTS

The plant is operated quite satisfactorily with the above complement of staff and the addition of a casual labourer. Mr. R. P. Ranton was transferred in October to another plant as Chief Operator and was replaced by W. R. Marriott. The plant was staffed 24 hours per day, seven days per week, each man having the equivalent of two days off per week.

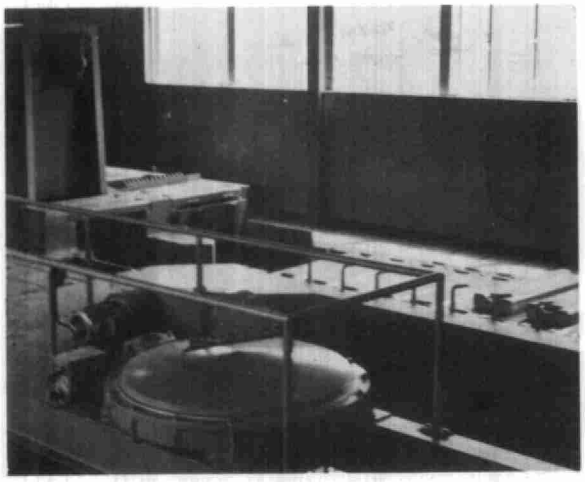
A reduction in the number of hours of coverage to sixteen is expected during 1965. This should result in better maintenance and eliminate the need for a casual labourer. Vacation coverage will be made with the existing staff.

Mr. J. Gotts successfully completed the OWRC series of operator instruction courses in Toronto during 1964. It is expected that Mr. J. Craig will attend these courses during 1965.

Description of Project

INFLUENT WORKS

An inlet channel, fitted with a storm overflow weir for flows in excess of 16 MGD, conducts the sewage from two large concrete sewers to the screening chamber. The screening chamber is divided into two parallel channels, one of which contains a "barminutor" which cuts and shreds the solid materials in the sewage. The second channel is fitted with a manually cleaned bar screen used only when it is necessary to by-pass the barminutor.



INFLUENT WORKS

Flow continues by gravity to a shallow settling tank where grit settles out and is removed by a Dorr detritor mechanism. A grit washing mechanism and organic return pump completes the influent works. The cleared grit is discharged to a barrow and subsequently disposed of by burial on the plant grounds.

PRIMARY CLARIFIERS

Four circular concrete clarifiers, each 80' in diameter, receive flow from the influent works. Primary sedimentation of flows up to 8 MGD is accomplished using two tanks and the other two are kept empty to handle storm flows up to 16 MGD. In either instance, the minimum detention is two hours.

Circular sludge collector and scum collector mechanisms move the settled and the floating primary sludge to sludge hoppers. This primary sludge

is then pumped to the digestion tank via sludge pumps located in the machinery building.

The primary clarifier effluent flows over a peripheral weir and is directed to a main sewage pump well under the machinery house.

AERATION

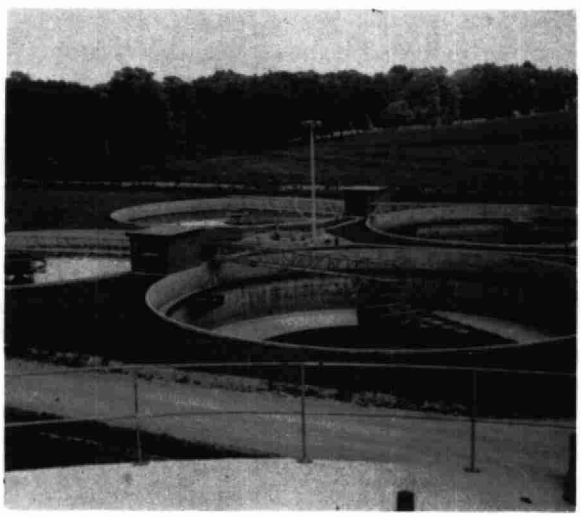
Main sewage pumps lift a maximum of 8 MGD from the pump well to five triple pass aeration tanks where it is mixed with activated sludge returned from the final settling tanks. In the aeration tanks air is introduced into the mixed liquor through. 7" diameter steel dome diffusers.

The air is supplied by three compressors, each with a capacity of 1750 cubic feet per minute at 7 psi.

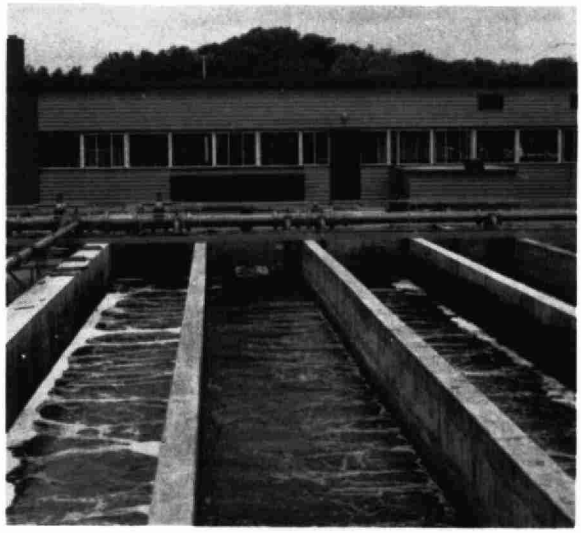
The aeration section provides five hours detention on a 4 MGD flow.

FINAL CLARIFIERS

Two 80 foot diameter concrete final clarifiers detain the flow from the aeration tanks, allowing the activated sludge to settle out. Some of this activated sludge is returned to the head of the aeration tanks to supply the bacteria needed for aerobic digestion of the solids loading from the primary tanks. The remaining activated sludge is "wasted" to the primary clarifiers where it settles and joins the raw sludge going to the digestion tank.



PRIMARY CLARIFIERS



AERATION TANKS

The clear liquid overflows a peripheral weir and is conducted to the river as final effluent.

SLUDGE DIGESTION TANK

Sludge from the primary clarifier composed of raw sludge, scum and waste activated sludge is pumped to a circular two stage digester. The digester is 73 feet in diameter, 26 feet deep, and has a capacity of 100,000 cubic feet.

A cylindrical partition wall divides the digester into two compartments. Active digestion, incorporating recirculated gas mixing and heating coils to maintain a temperature of about 95° F. takes place in the inner tank which has a capacity of 67,600 cubic feet. The annular outside compartment forms a quiescent zone where gradual settling occurs. Supernatant liquid which has a very low percentage of solids is gravitated to the primary clarifiers.

Thickened digested sludge is piped from the digester to a sludge storage tank and is transported under contract to farm land where it is used as a soil conditioner.

The digestion process requires about one month. Methane gas, formed during digestion, is stored under the digester roof and used as fuel for heating the plant.

PROJECT COSTS

LONG TERM DEBT: (Total Capital Cost)	$925,000.00

The total cost to the municipality during 1964 was as follows:

Net Operating	$ 53.649.88
Debt Retirement	18,666.00
Reserve	7,881.00
Interest Charged	52,040.74
TOTAL	$132,237.62

RESERVE ACCOUNT

Balance at January 1, 1964	$ 42,378.12
Deposited by Municipality	7,881.00
Interest Earned	2,505.71
	$ 53,764.83
Less Expenditures	1,106.34
Balance at December 31, 1964	$ 51,658.49

DEBT OUTSTANDING	$794,068.53

MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY	WATER
JAN	2482.10	2009.24	208.80				93.19	96.82	54.15	19.90	
FEB	4157.14	2009.24	183.40		479.52	47.92	243.82		743.52	397.38	52.34
MARCH	3855.21	2198.13			447.01		220.21		227.28	710.24	52.34
APRIL	3651.77	2074.34			467.53		229.10		49.63	778.83	52.34
MAY	6009.23	3124.25	261.44	(9.02)	451.33		280.15		1295.20	553.80	52.08
JUNE	3939.84	2379.57	258.28	30.65	440.73		184.66	109.13	385.96	98.78	52.08
JULY	4397.74	2086.50	296.96		477.00		178.46		202.51	1104.23	52.08
AUG	4897.77	2086.50	255.28		507.78		210.31	34.98	165.61	1585.23	52.08
SEPT	4505.18	2086.50	239.37		514.26	47.46	141.79		35.93	1387.79	52.08
OCT	4647.15	2086.50	256.78	20.69	507.60		312.31	117.40	371.06	922.73	52.08
NOV	4230.20	1745.68	255.32	27.03	502.56		86.64	18.02	95.27	1447.60	52.08
DEC	6876.55	2813.52	364.72		1106.28		284.72	219.01	571.83	1412.31	104.16
TOTAL	53649.88	26699.97	2580.35	69.35	5901.60	95.38	2465.36	595.36	4197.95	10418.82	625.74

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE $7539.00

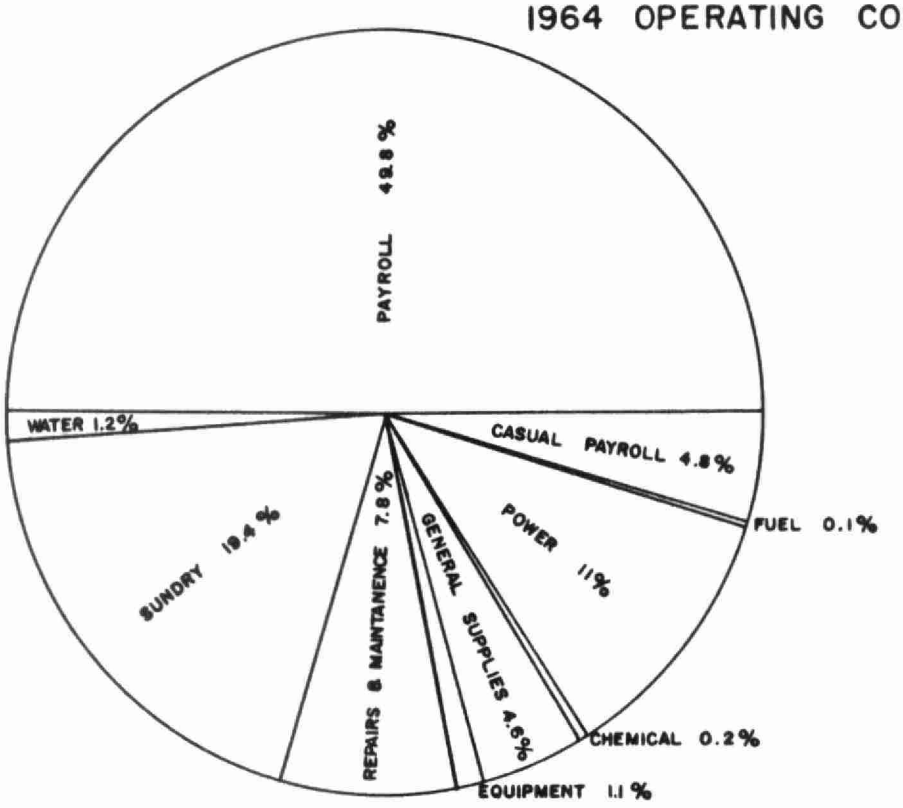
BRACKETS INDICATE CREDIT

YEARLY COSTS

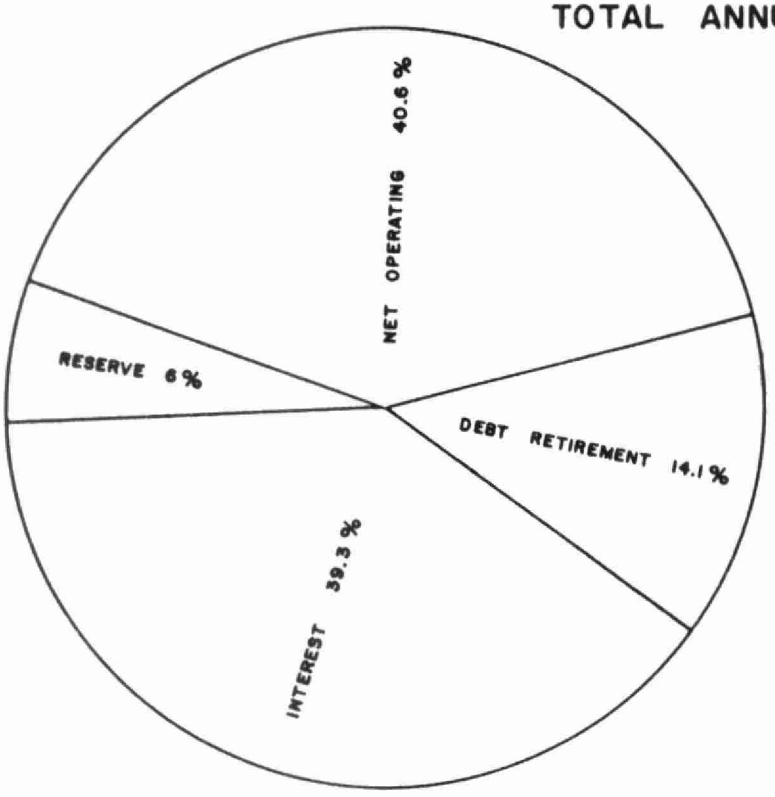
YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	933.41	$55015.86	* $10.30	$58.94	2 CENTS
1962	765.39	48157.96	9.01	62.92	3 CENTS
1963	774.22	52799.80	9.87	68.15	3 CENTS
1964	994.33	53649.88	9.59	53.95	3 CENTS

* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

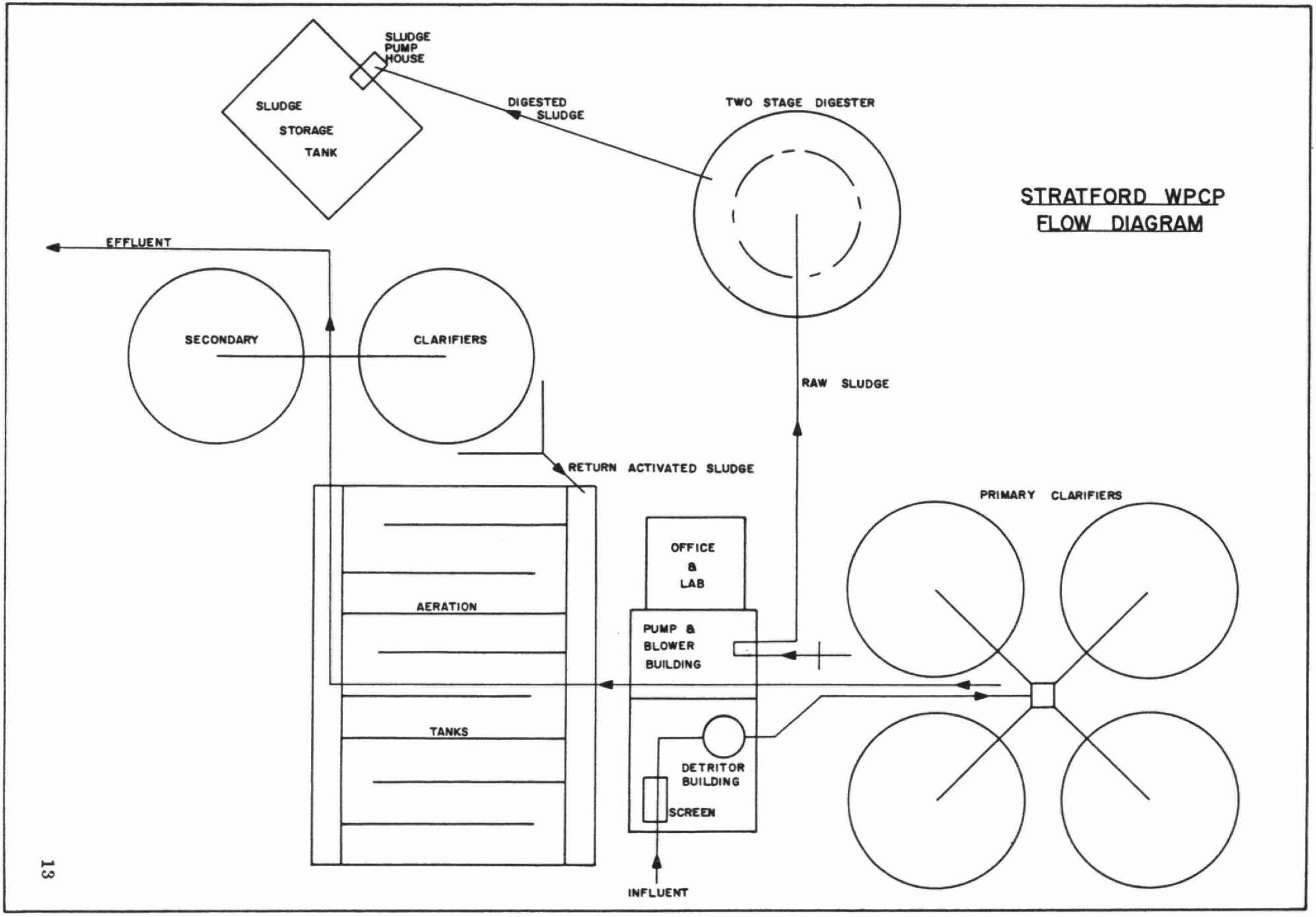
1964 OPERATING COSTS



TOTAL ANNUAL COST



Technical Section


SLUDGE PUMP HOUSE
SLUDGE STORAGE TANK
DIGESTED SLUDGE
TWO STAGE DIGESTER
STRATFORD WPCP
FLOW DIAGRAM
EFFLUENT
SECONDARY
CLARIFIERS
RAW SLUDGE
RETURN ACTIVATED SLUDGE
PRIMARY CLARIFIERS
OFFICE & LAB
AERATION
PUMP & BLOWER BUILDING
TANKS
DETRITOR BUILDING
SCREEN
INFLUENT

Design–Data

GENERAL

Type of Plant - Activated Sludge

- Diffused air aeration.

Design Population - 30,000 persons

Design Plant Flow - 4 mgd at D.W.F.
- Maximum total flow is 16 mgd.
- 8 mgd primary treatment only for storm flow.
- 8 mgd secondary treatment only.

Per Capita Flow - 130 gallons per capita per day.

Five Day BOD

Raw Sewage - 140 ppm

Removal - 90%

Suspended Solids

Raw Sewage - 250 ppm

Removal - 95%

PRIMARY TREATMENT

Screening

36 inch Barminutor-Chicago Model "C"
12 mgd capacity
Barminutor bypass screen.

Grit Removal

Dorr detritor
20' x 20' tank
1.4 min. detention at D.W.F.

PRIMARY CLARIFIERS

Number of Tanks - 4, 2 for all flows to 8 mgd.
- 2 for storm flows over 8 mgd.

Size - 80' diameter and 10.5 feet deep,

Type - concrete circular tanks, Infilco Model BF mechanisms.

Volume - 330,000 gallons per tank for a total of 1,320,000 gallons.

Weir Overflow Rate - 8,000 gallons per lineal foot per day at D. W. F. (using 2 clarifiers).

Surface Settling Rate - 400 gallons per sq. ft. per dau at D. W. F. (using 2 clarifiers).

Retention - 4 hours at 4 MGD (using 2 clarifiers).

SECONDARY TREATMENT

Number of Tanks - 5

Volume - total of 970,000 gallons

Retention - 5. 8 hours at 4 mgd

Return sludge colume - 20%

Air supply - 1. 22 cubic feet per gallon

Compressors - Rotary type - 1750 cfm at 7 psi.

FINAL SETTLING TANKS

Type - circular concrete tanks - Infilco model BD mechanism

Number of Tanks - 2

Size - 80 ft. diameter x 11' - 3" deep

Volume - 705,000 gallons total

Retention - 4 hours at 4 mgd

Surface Settling Rate - 400 gallons per sq. ft. per day at 4 mgd.

Weir Overflow Rate - 8,000 gallons per lineal ft. of weir per day at 4 mgd.

DIGESTION SYSTEM

Type - heated two stage digester

Size - 73' diameter x 26' depth

Total volume - 100,000 cubic ft.

Primary Stage - 67,600 cubic ft.
- 2. 25 cubic ft. per capita
- 1. 85 lbs. solids per cubic ft. per month.

Secondary Stage - 32,400 cubic ft. ring around primary stage.

Sludge disposal - liquid haulage by contractor.

EFFLUENT

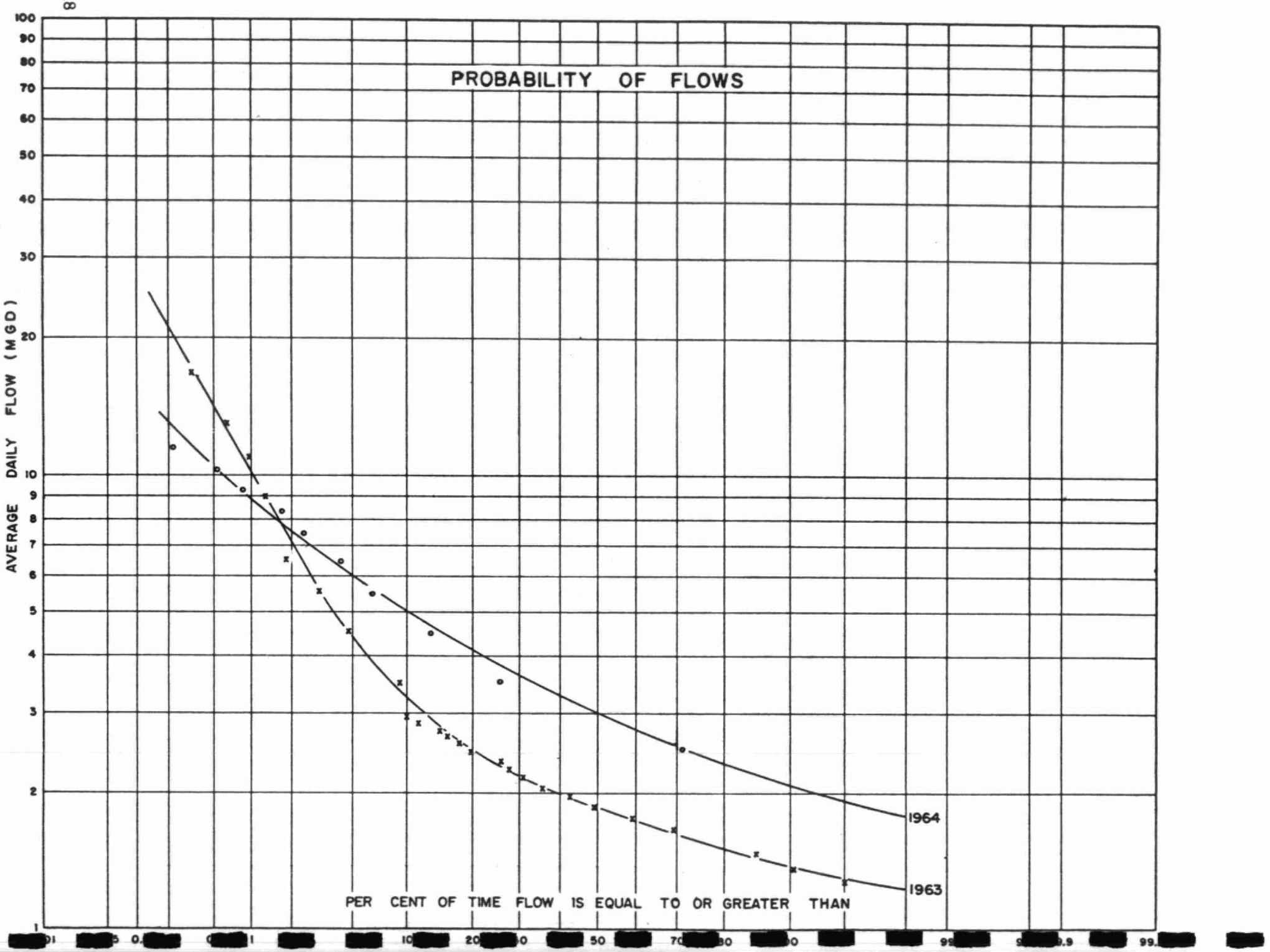
Discharged to Avon River.

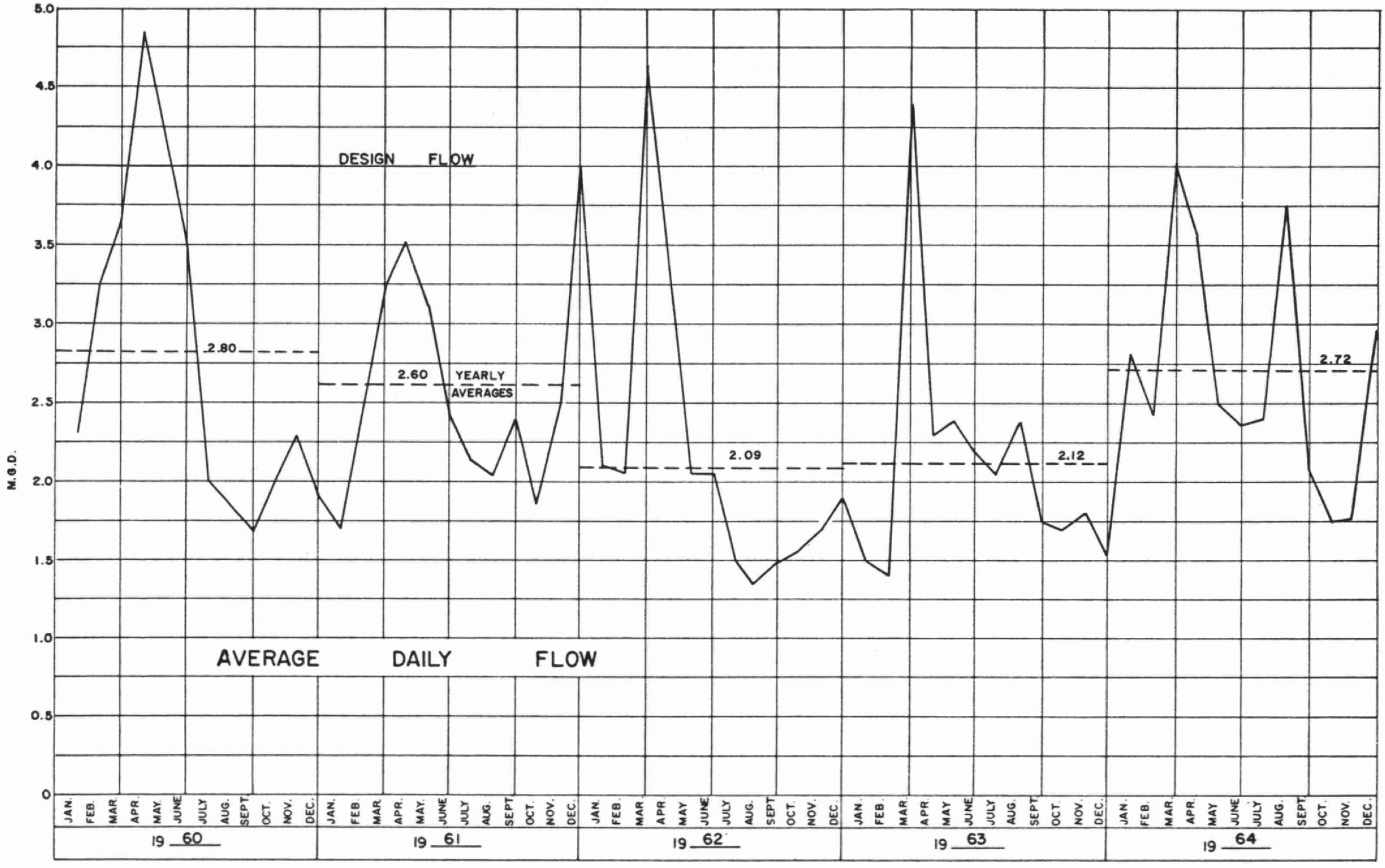
Process Data

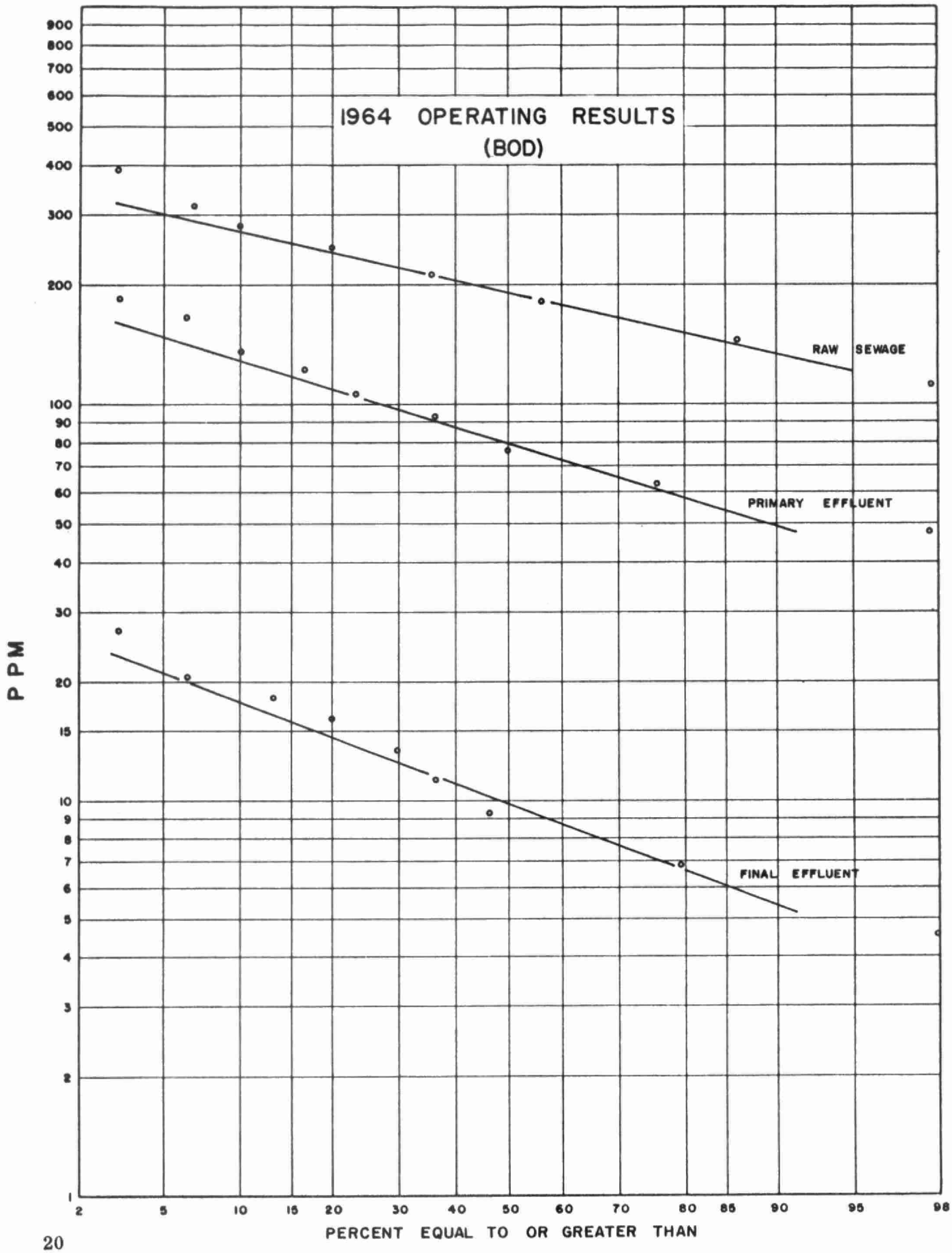
The average daily flow and total flow for the year were greatly increased over the 1963 flows. During 1964, the average daily flow was 2.72 million gallons, an increase of 28% over the average of 2.12 million gallons per day received during 1963. 993 million gallons of raw sewage composed of both industrial and domestic wastes received complete treatment.

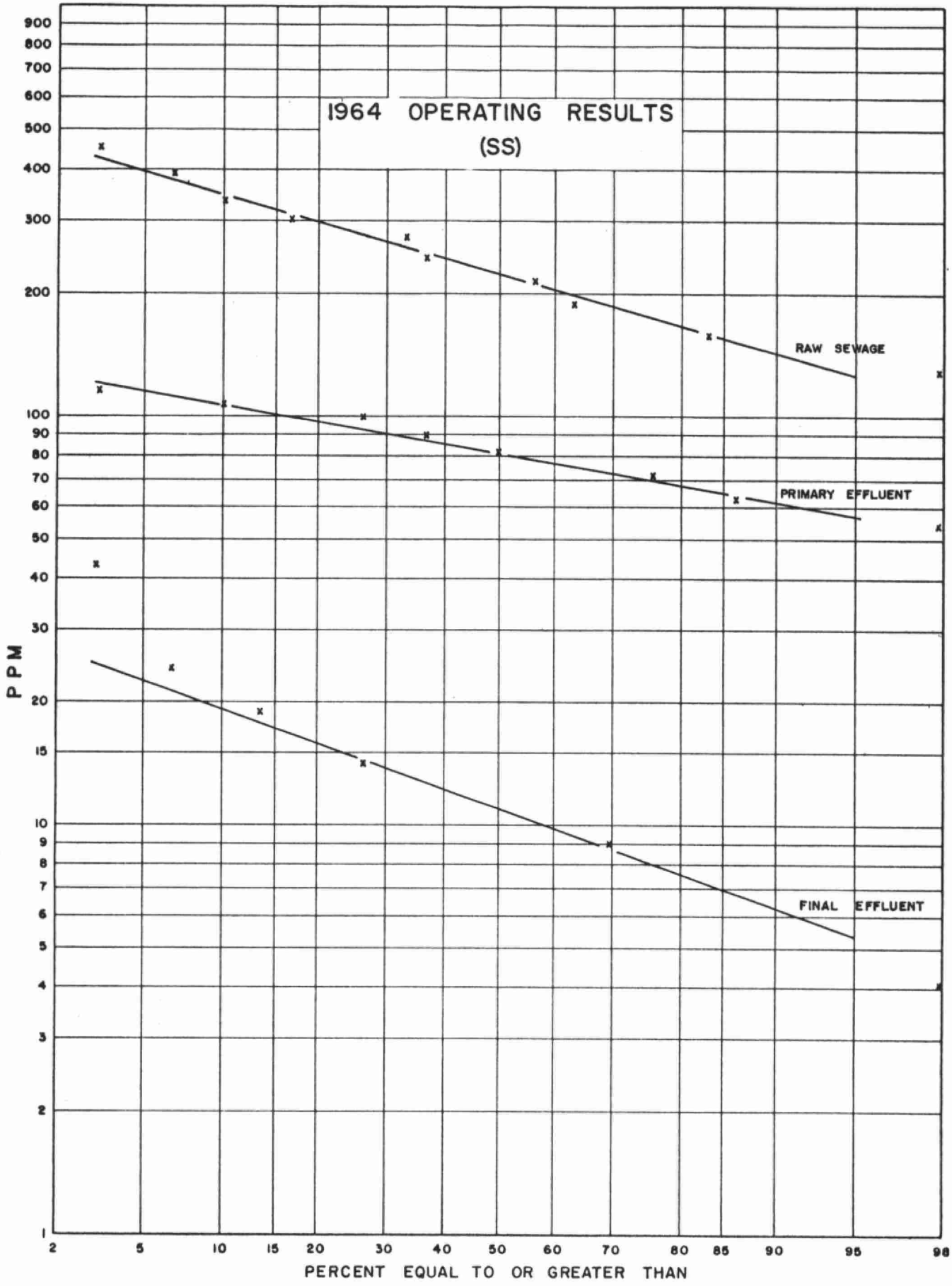
The maximum 24 hour flow in the past year was 11.5 million gallons and occurred in the month of January. The maximum rate of flow recorded was 17 MGD. The versatility in design of this plant enables flow rates up to 8 million gallons per day to receive complete treatment for short periods. In addition, two of the primary tanks are used as storm units and can be used to store flash flood waters for treatment when the flow subsides. Primary treatment can be given to flow rates up to 16 million gallons per day. For these reasons, it is only on very rare occasions that part of the flow must be bypassed.

The probability curves are compound; the steeper sloped portion representing storm flows and the lesser sloped portion representing normal dry weather flows.


PROBABILITY OF FLOWS
AVERAGE DAILY FLOW (MGD)
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
1964
1963
PER CENT OF TIME FLOW IS EQUAL TO OR GREATER THAN


5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
M.G.D.
DESIGN FLOW
2.80
2.60
YEARLY AVERAGES
2.09
2.12
2.72
AVERAGE DAILY FLOW
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
19 60
19 61
19 62
19 63
19 64


1964 OPERATING RESULTS
(BOD)
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
PPM
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT EQUAL TO OR GREATER THAN


1964 OPERATING RESULTS
(SS)
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
PPM
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
2
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85
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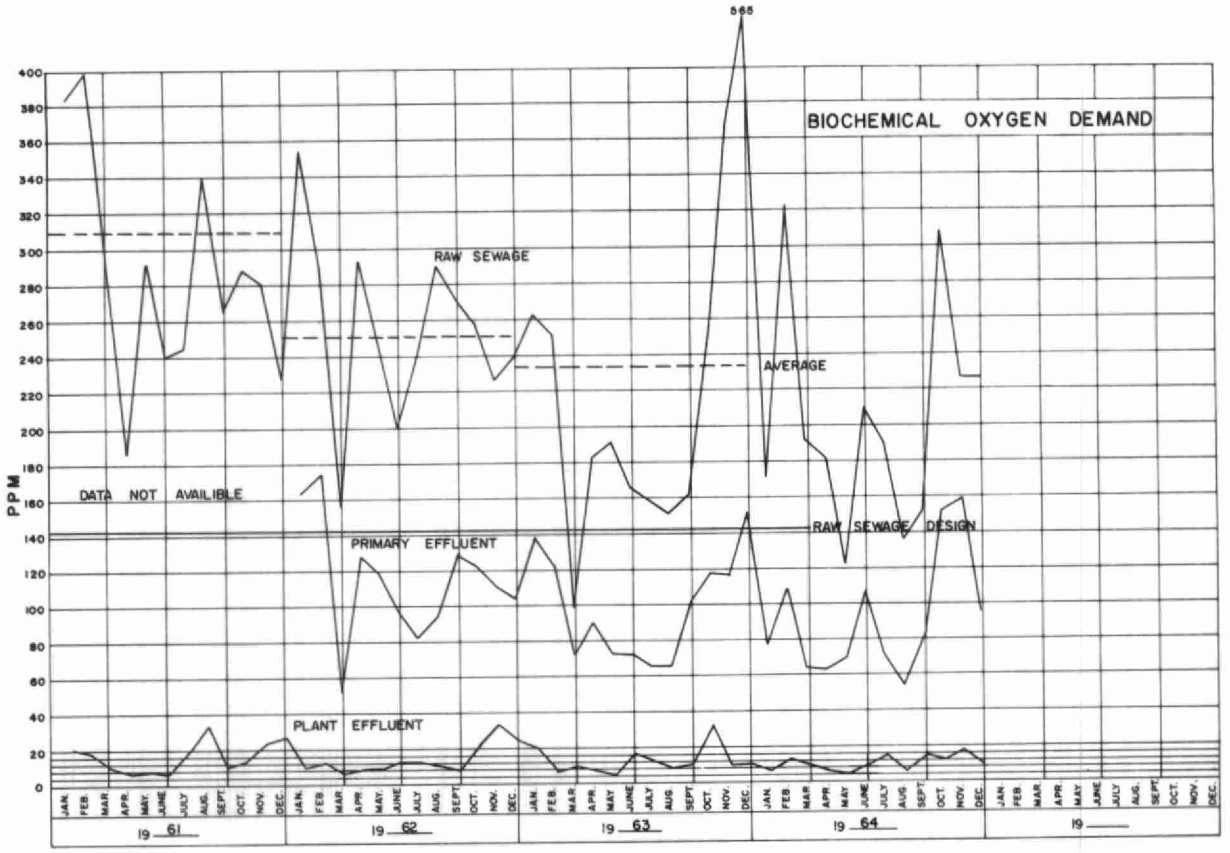
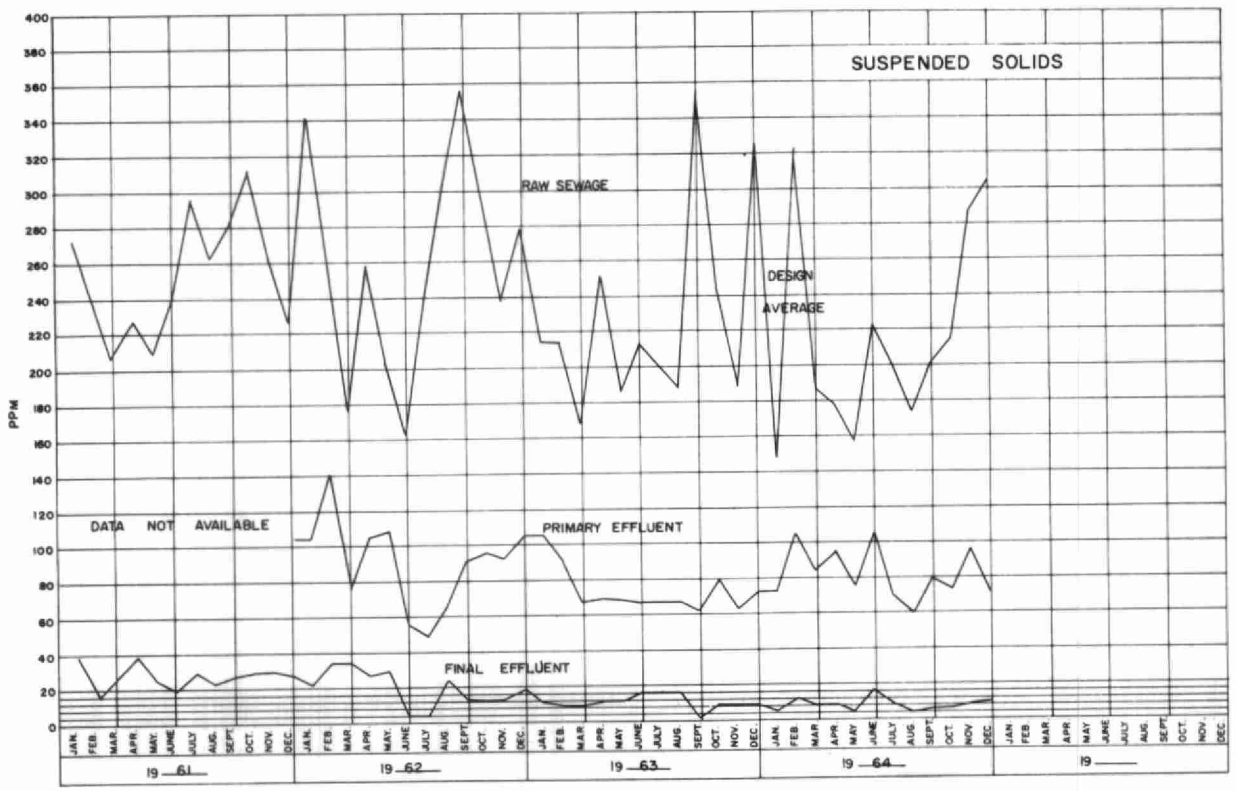
95
98
PERCENT EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



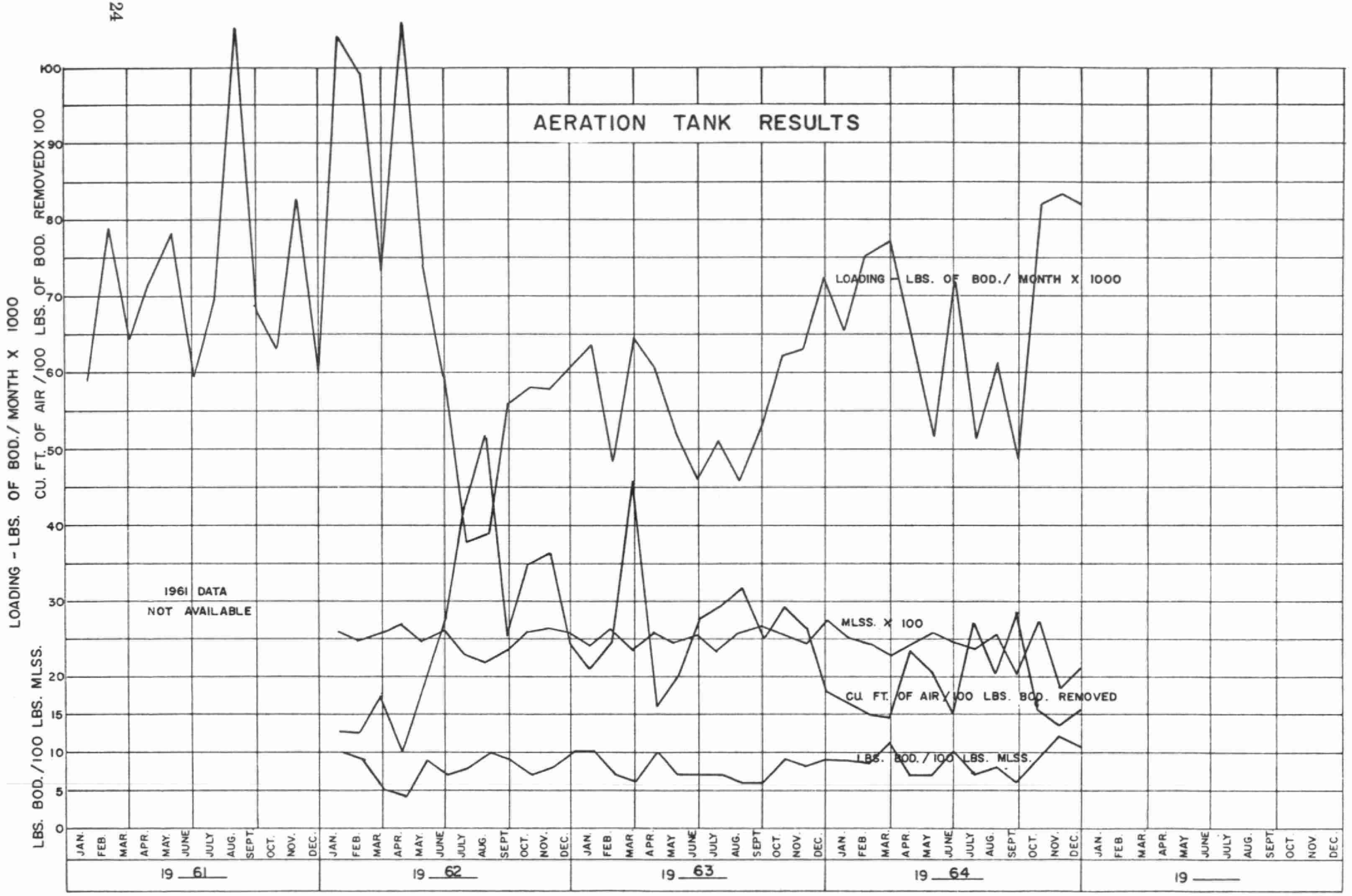
GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	164	6.5	96	69.4	150	5	96.5	63.9	131
FEB.	316	12.4	96	107.4	327	26	92	106.5	62
MAR.	190	9.5	95	113.6	266	14	94.5	158.6	61
APR.	180	6	96.5	83.3	239	10	96	122.8	59
MAY	120	4.3	96.5	44.9	159	6	96	59.4	72
JUNE	208	8.3	96.0	71.3	225	17	92.5	74.2	147
JULY	188	14	92.5	65.1	202	10	95.0	71.9	222
AUG.	134	6.2	95.5	75.2	176	5	97.0	100.6	353
SEPT.	150	14.0	90.5	42.8	203	6	97.0	62.0	81
OCT.	308	12	96.0	81.1	216	7	96.5	57.3	111
NOV.	225	17	92.5	55.7	289	9	97.0	75.0	90
DEC.	225	10	95.5	96.0	307	10	96.5	132.7	173
TOTAL	-	-	-	949.6	-	-	-	1093.8	1562
AVG.	201	10	95.0	79.1	230	10	95.5	91.2	130

COMMENTS

The average BOD loading at this plant of 201 ppm is still above the design value of 140 ppm. The average suspended solids concentration of 230 ppm is slightly less than the design value of 250 ppm. The average values of the effluent quality are better than the Commission objectives of 15 ppm for both BOD and suspended solids.

Chlorination of the final effluent is not presently practiced at the plant. Surveys of the receiving stream have indicated the necessity of providing chlorination facilities to maintain a coliform count of less than 2400 units per 100 ml in the stream.

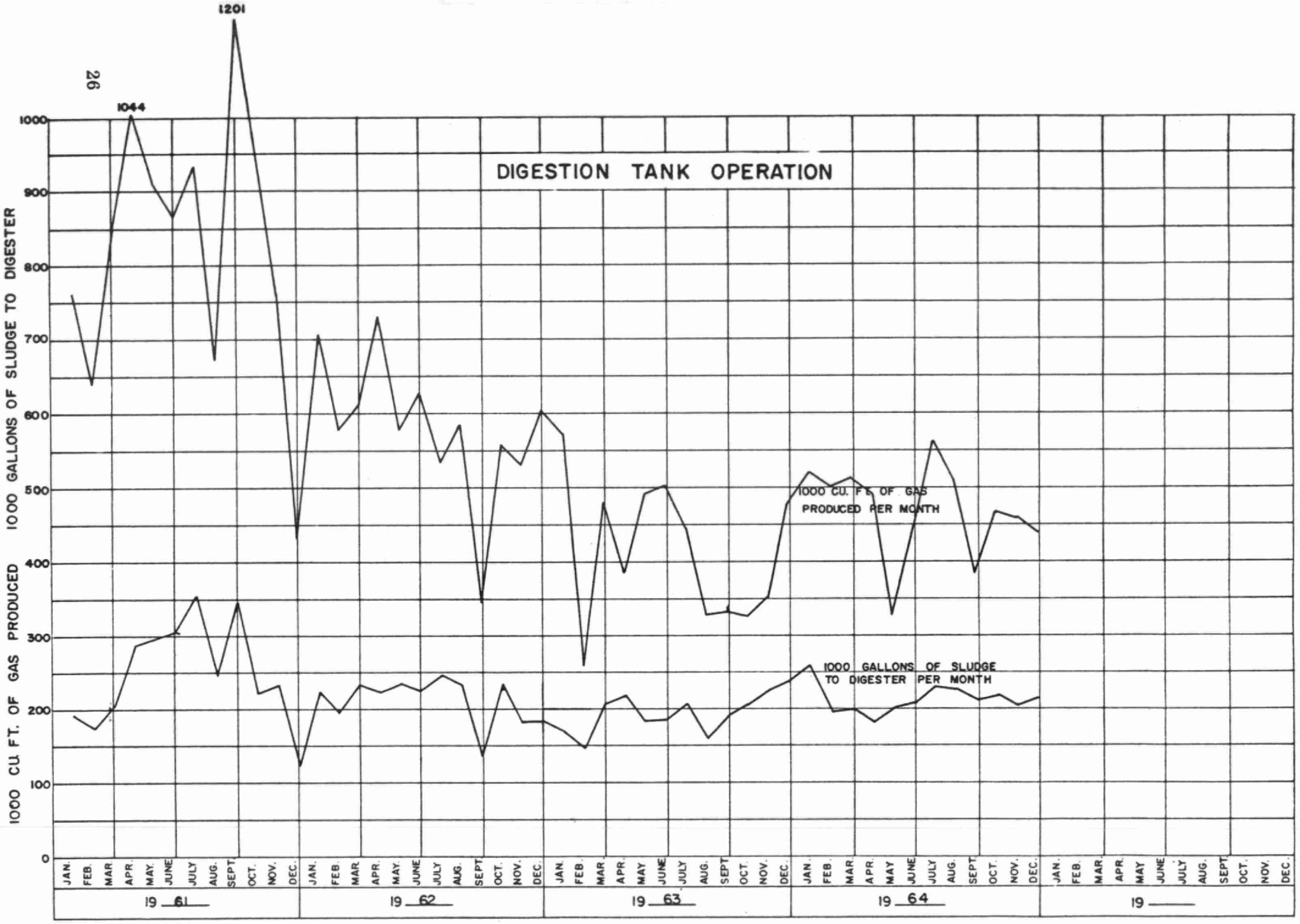

AERATION TANK RESULTS
LOADING - LBS. OF BOD./ MONTH X 1000
CU. FT. OF AIR /100 LBS. OF BOD. REMOVEDX 100
LBS. BOD./100 LBS. MLSS.
LOADING - LBS. OF BOD./ MONTH X 1000
MLSS. X 100
CU. FT. OF AIR/100 LBS. BOD. REMOVED
LBS. BOD./100 LBS. MLSS.
1961 DATA
NOT AVAILABLE
0
5
10
15
20
30
40
50
60
70
80
90
100
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
19 61
19 62
19 63
19 64
19

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. B.O.D. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	74	2520	9	1654
FEBRUARY	106	2460	10	1502
MARCH	61	2298	11	1490
APRIL	60	2428	7	2346
MAY	66	2596	7	2069
JUNE	102	2489	10	1505
JULY	69	2393	7	2729
AUGUST	52	2558	8	2053
SEPTEMBER	77	2510	6	2869
OCTOBER	150	2710	10	1578
NOVEMBER	156	2736	12	1374
DECEMBER	92	2257	11	1556
TOTAL	-	-	-	-
AVERAGE	89	2496	9	1894

COMMENTS

The aeration loadings indicate an average BOD reduction in the primary clarifiers of 56%. The aeration loading of 9 pounds BOD per 100 pounds MLSS is considerably less than the 20 to 40 lbs. usually recommended. The M. L. S. S. have been kept at a relatively high value to counteract the foam problem. The use of fuel oil has been successful in controlling the remaining foam. The effluent quality does not appear to be impaired by the high M. L. S. S.; however, experiments to be carried out in 1965 will determine the effect of lowering the M. L. S. S. and thereby increasing the pounds of BOD per 100 lbs. of M. L. S. S.


DIGESTION TANK OPERATION
1201
1044
1000 CU. FT. OF GAS PRODUCED PER MONTH
1000 GALLONS OF SLUDGE TO DIGESTER PER MONTH
1000 CU. FT. OF GAS PRODUCED 1000 GALLONS OF SLUDGE TO DIGESTER
0
100
200
300
400
500
600
700
800
900
1000
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 61
19 62
19 63
19 64
19

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU.FT.	% SOLIDS	% VOL. MAT.	1000'S CU.FT.	% SOLIDS	% VOL. MAT	
JAN.	41.36	5.64	4.06	33.64	3.13	1.94	522.60
FEB.	31.80	6.02	4.29	40.07	3.70	2.24	504.19
MAR.	32.04	7.64	5.38	19.47	4.08	2.31	511.84
APR.	28.92	6.94	*	8.88	4.15	*	493.47
MAY	32.36	6.62	4.62	58.21	4.75	2.64	329.86
JUNE	33.56	6.36	4.31	53.49	4.48	2.62	333.76
JULY	38.38	6.60	4.22	32.51	4.65	2.49	565.05
AUG.	37.14	6.48	3.97	43.09	4.08	2.10	511.86
SEPT.	34.33	5.96	3.84	33.26	4.48	2.36	368.33
OCT.	35,03	5.64	3.97	38.74	4.20	2.30	467.85
NOV.	32.74	5.14	3.80	29.86	3.95	2.21	460.66
DEC.	33.91	5.38	3.84	51.01	3.40	2.07	440.34
TOTAL	411.57	-	-	442.23	-	-	5509.81
AVG.	34.30	6.20	4.21	36.85	4.09	2.30	459.15

* heater element broken. No test performed.

COMMENTS

It would appear from the above values that the digester is producing more sludge than is put into it. This difference of 1/3 the digester capacity has occurred due to winter storage requirements. In previous years, excess sludge was stored in an outdoor storage lagoon. It is not expected that the lagoon will be used in the 1964-65 winter.

Gas production has increased in 1964 over the 1963 production.

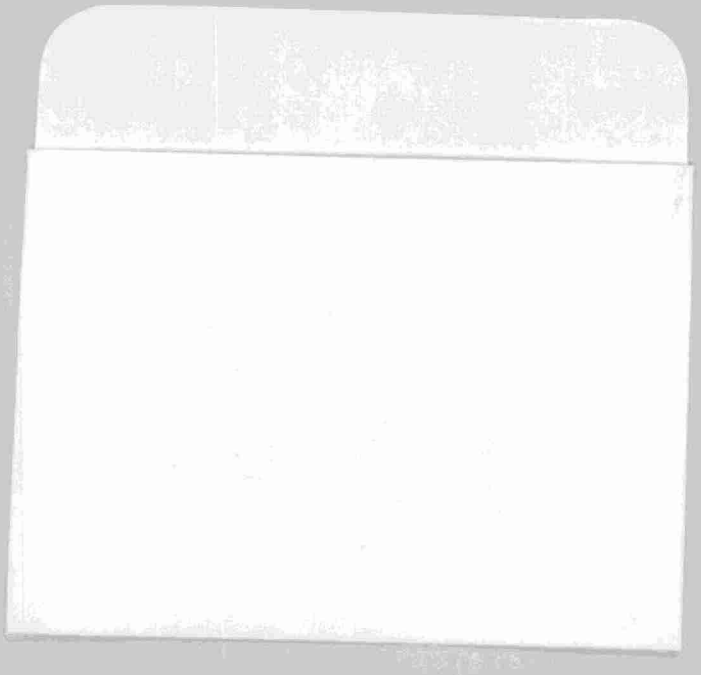
CONCLUSIONS

The data given in this report serve as a useful reference for all who are concerned with the operation of the Stratford Water Pollution Control Plant. This data will be especially valuable when the plant requires expansion in the future.

During the year, the plant has produced an excellent effluent having average values of BOD and suspended solids concentrations well below the commission objectives of 15 ppm.

RECOMMENDATIONS

The digester, as designed, has never produced a supernatant; however, individual samples of sludge will supernate on standing. A detailed examination and possible structural change should be considered to obtain supernatant in order to reduce the cost of sludge haulage at the plant.




ONTARIO WATER RESOURCES COMMISSION